BELGIAN COMPANY SALYP N.V. SAYS IT HAS DEVELOPED A SYSTEM THAT CAN PROFITABLY RECYCLE SHREDDER FLUFF. HERE'S AN INTRODUCTION TO ITS INTRIGUING PROCESS.

BY KENT KISER

FINDING VALUE IN FLUFF

It's a familiar story in the shredding industry: Someone claims to have developed *the* solution for recycling shredder fluff. Shredder operators check out the proposed solution, only to find that it's impractical, unprofitable, technically unsound, or outright harebrained. No wonder most shredders are skeptical whenever they hear about "the next big thing" in fluff recycling.

Salyp N.V. hopes to change all that.

Salyp, a 5-year-old technology company based in Ypres, Belgium, claims to be "the first and only company in the world to demonstrate a commercially viable, automated process for recycling plastics from metal recyclers' shredder residue."

The question, of course, is this: Is Salyp the real deal or just the latest entrant in the elusive search for *the* fluff-recycling solution? Read on and decide for yourself.

SEEKING END-OF-LIFE VALUES

First, a few basics: Today, an automobile shredder recovers about 75 percent of a car hulk, or end-of-life vehicle (ELV) in European parlance. That 75 percent includes basically just the car's ferrous and nonferrous metals. The remaining 25 percent—the "fluff"—includes everything else from the car, such as plastics, polyurethane foam, residual metals, fabric, rubber, glass, and dirt. Fluff has long been considered a waste and has thus been discarded, burned in incinerators, or beneficially "reused" as daily cover in landfills.

Though many fluff-recycling approaches have been developed, none has been technically and/or commercially successful. Recognizing that fact, Salyp knew it had to offer a system that (1) worked and (2) turned a profit. If it achieved those goals, there would be the extra environmental payback of recycling shredder fluff instead of landfilling it.

Salyp based its recycling technology on the simple concept that shredder fluff contains materials with intrinsic value. When shredder operators landfill or burn their fluff, they are throwing away that value. Salyp, in fact, has taken this "value concept" so far as to secure the rights to its own definition of the acronym ELV. Instead of end-of-life vehicle, Salyp defines ELV as end-of-

life *values*, and it plans to license this definition to clients who purchase its ELV Center system.

To recover the value in fluff, Salyp developed a system composed of eight major pieces of equipment that together recover six products from fluff—iron fines, polyurethane foam, three grades of plastics, and ferrous/nonferrous metals.

SALYP N.V.

Salyp's headquarters in Ypres, Belgium, houses the firm's offices and demonstration plant, a "showroom of recycling" that enables Salyp to show clients how its system works and the products it recovers.

Overall, the Salyp system can recycle 80 percent of the content in shredder fluff, the company says. By recovering this additional content, Salyp's system enables shredder operators to boost their total per-car recovery rate from the traditional 75 percent to 95 percent. The remaining waste from the Salyp process—mostly fabric and wood—can be landfilled or used as a fuel in an on-site combustion system that Salyp offers as an option to its system. (Notably, this combustion system would enable the operator to recycle 100 percent of a car while also meeting half of the plant's energy needs, the firm says.)

TOURING THE PROCESS

Interestingly, Salyp named the eight major components of its recycling system after constellations—Hercules, Volantis, Aquarius, Aquila, Tucana, Orion, Pavo, and Dorado. Here's your intro to each of them as we describe Salyp's process from beginning to end:

Hercules: Though some fluff-recycling approaches begin by processing the material into uniformly sized pieces, Salyp instead leaves the material as is and sorts it into different-sized fractions. Salyp does this through the Hercules system, a "fluff separator" that features two big trommels placed on top of each other. This "double-stacked" sieving system, developed by Central Manufacturing Co. Inc. (Groveland, Ill.), can sort 11,000 to 17,600 pounds an hour of fluff into four size fractions: less than 6 mm; 6 to less than 16 mm; 16 to less than 38 mm; and 38 mm and larger.

The two smallest fractions are a mixture of ferrous fines, nonferrous fragments, glass, fabric/textiles, and other organic components. Using sorting technology developed by FREN (Leoben, Austria), this mixture is divided into two streams—one containing nonferrous and glass, the other containing the iron fines and organic materials. The latter stream has a high iron-oxide content that makes it attractive to both the cement industry for the production of clinker and the direct-reduction industry for the production of DRI pellets. The iron fines and organic materials are simply briquetted together, with the organic content helping to reduce the fines during DRI production.

With the two smallest fractions recovered, the Salyp system then takes on the two larger fractions.

Volantis: The largest fraction (38 mm and larger)—consisting mostly of big pieces of plastics and dirty polyurethane foam—heads for the Volantis system (another Central Manufacturing creation), which is designed to separate the foam from the plastics at a rate of about 3,300 pounds an hour. Volantis does this by conveying the material under an accelerated roller that compresses the foam. When the foam emerges from the roller and springs back into shape, that action and the roller's speed make the foam "jump" off the conveyor and over an adjustable splitter, separating the foam from the plastics-rich portion of the fluff. The foam then heads to the Aquarius system.

Aquarius: Before the polyurethane foam can be considered a recovered product, it must be cleaned. That's the job of the Aquarius, a foam-cleaning system developed by Argonne National Laboratory (Argonne, Ill.). Salyp has an exclusive license to market the system, which it claims is "the world's only continuous and mechanical polyurethane foam recycling technology."

The system can process about 700 pounds an hour of foam in a three-step process: washing with a bacteriological cleaner, rinsing, then dewatering/drying. Throughout, punctured rollers continuously squeeze and release the foam to ensure thorough cleaning and drying. All water used in the system is cleaned and recirculated, while the extracted dirt/sludge is extracted auto-

The first stop for incoming shredder fluff is the Hercules, a double-stacked sieving trommel system that sorts the fluff into four distinct size fractions.

matically by a conveyor and collected for disposal. The clean, dry foam is then baled and ready for reuse in such "high-end" applications as carpet padding, acoustic insulation, compression-molded products, and more.

So much for the polyurethane foam. Now we have to take a step back to see what happens with the 16 to less than 38 mm fraction from the Hercules system as well as the plastics-rich stream separated by the Volantis.

Aquila: As it turns out, both of those streams head for the same place—a series of three machines integrated in one line. The first of this series is the Aquila, a patent-pending system developed by Salyp. This "innovative, yet simple device" separates the plastics, metals, and wood from the fibers/textiles, which frequently trap other materials, thus preventing their recovery. The fibers/textiles are either conveyed into a container for disposal or fed into the optional combustion system that can provide half the power for the Salyp system.

Tucana: The plastics/metal/wood stream from the Aquila, meanwhile, heads for the second machine in the integrated series—the Tucana, which shreds the mixed material to a size range of 25 to 44 mm at a rate of about 4,400 pounds an hour. After this size-reduction process, an air system extracts any residual light materials from the mix while a magnet pulls off any ferrous pieces.

Orion: The shredded stream—which now includes plastics, wood, and some nonferrous metals—then heads for the third inline machine named Orion, a sorting system developed by Separation Systems Engineering GmbH (Wedel, Germany) and licensed by Salyp for use in its recycling plants. Using optical sorting technology and precision air jets, the Orion system blows the nonferrous and wood pieces from the plastic stream, processing 4,400 to 6,600 pounds an hour. The nonferrous is subsequently recovered from the wood through a traditional eddy-current separation system.

Pavo: Next, the wood- and metal-free plastic stream heads for the Pavo, a trommel system modeled after a potato washer that cleans the plastic chips in preparation for sorting.

Dorado: The centerpiece of Salyp's process is the Dorado, which enables the recovery of engineering plastics in shredder fluff. These plastics include polypropylene (PP), polyethylene (PE), acrylonitrile-butadiene-styrene (ABS), polycarbonate (PC), polyamide-nylon (PA), and polyethylene terephthalate (PET).

According to Salyp, 75 percent of plastics in shredder fluff are thermoplastics—that is, plastics that can be recycled by heating, softening, melting, and reforming into new products. The remaining 25 percent of fluff plastics are a mix of thermosets and rubber, which do not melt at moderate temperatures and which can only be reprocessed as fillers or after chemical recycling.

The Dorado technology, developed by a German engineer named Urban Stricker, is based on the softening characteristics of different thermoplastic polymers. In the system, the mixed plastic chips are first preheated to 70 degrees C in a trommel, then fed onto a vibrating table that spreads them into a single layer for effective sorting. Next, the chips pass under the first of two banks of infrared heaters. The first heaters bring the plastic chips to a specific temperature at which the PP chips become "butter soft"—not hard and not melted. As the chips pass under a metal roller with fine grooves in it, the softened PP chips cling to the roller grooves and are extracted from the mix.

The Aquarius cleans dirty polyurethane foam in a three-step process of washing, rinsing, and dewatering/drying. Throughout, perforated rollers squeeze and release the foam to ensure thorough cleaning and drying.

The remaining chips then pass under the second bank of infrared heaters, which warm the chips to another specific temperature at which the PE/PP polyolefins become butter soft. As before, these softened chips cling to another grooved roller and are removed from the stream. The temperature of the rollers is a critical factor, Salyp notes—if they're too cool, the plastic chips will harden and stick to the rollers; if they're too hot, the chips will melt on the rollers.

After the second roller, the remaining mixed "downstream" plastics are conveyed to a container at the end of the line.

The Dorado system, which is PLC-driven and computer-monitored, can reportedly process 3,000 pounds an hour of mixed plastics at a conveyor speed of about 50 to 83 feet a minute. The speed and sorting ability of the Dorado is truly the linchpin of Salyp's system. Without it, the firm states, "it would have been impossible to offer an economic fluff-recycling line."

THE FACTORS OF SUCCESS

That, in a nutshell, is Salyp's fluff-recycling system, which Salyp is confident won't suffer the same fate as previous approaches. The company

Salyp's co-CEOs Omer Saelens and Ivan Vanherpe join COO Carl Gisquière in Salyp's demonstration center in Ypres, Belgium.

THE SALYP STORY

Salyp N.V. is the brainchild of the Saelens family of Belgium, which built its reputation in various automotive businesses–from new-car sales to parts. This automotive background led the family, under patriarch Hubert Saelens, to develop an interest in car recycling.

First, the family explored the pros and cons of dismantling end-of-life vehicles (ELVs) but found that approach too slow and uneconomical. Then it heard about the car-shredding industry and the problems with shredder fluff.

Intrigued, the family researched existing and proposed fluff-recovery approaches to learn what worked, what did not work, and why. Its research even included a visit in 1997 to Argonne National Laboratory (Argonne, Ill.), which had created a process for recovering clean polyurethane foam from shredder fluff.

Armed with its extensive research, the Saelens family decided to develop its own fluff-recycling process, borrowing from the best existing processes (such as Argonne's foam-recycling system) as well as developing its own techniques. To pursue this new business venture, the family founded Salyp N.V. in 1998, whose name is a combination of Saelens and Ypres, the Belgian town where the company is based. Hubert Saelens became the new firm's president, with son Omer Saelens and long-time employee Ivan Vanherpe sharing CEO duties.

Salyp decided from the start that it needed a "showroom of recycling" where it could show its process to prospective clients. As in the new-car sales business, Salyp knew that customers would prefer to see the actual product, not just read about it on paper. As a result, Salyp built in 1999 a full-scale demonstration center in Ypres, where it continues to display and refine its ELV Center technology.

bases its confidence on several factors:

The Technology. The Salyp system truly works, the company asserts, and it's willing and able to prove that claim to skeptical shredders.

From the start, Salyp decided that it could best sell its recycling system by showing it in operation to potential clients. Toward that end, Salyp built a full-scale demonstration plant in Ypres, Belgium, so shredder operators could see its system for themselves, scrutinize the products it recovers, and even run loads of their own fluff through the system. "Just like a new car is sold in a showroom and people want to test-drive before they purchase, Salyp sells its equipment by proving, feeling, touching, and convincing," the company says. For clients who can't visit the demonstration plant, Salyp offers to provide a personalized streaming video demonstration of the equipment. The rationale behind such moves is this: If clients see the process in action, the technology will not only prove itself but also sell itself.

Profit Potential. The Salyp system can turn a profit, the firm states. Salyp bills its system upfront as "a profit center for the recovery of products from shredder residues." To make a profit, of course, shredder operators would have to be able to sell the recovered products at prices that would more than cover their costs. Not a problem, Salyp says, asserting that "our customers can easily sell the recovered products at the following prices": DRI briquettes, $10 a ton; clean polyurethane foam, $200 a ton; PP chips, $200 a ton; polyolefin (PP/PE) chips, $150 a ton; engineering plastics (ABS/PC/PET), $300 a ton; and mixed nonferrous metals, $650 a ton.

So confident is Salyp in the value of these recovered products that it and its sales agents worldwide offer to buy their clients' materials (except the nonferrous metals, which Salyp assumes clients would prefer to sell themselves) for a "guaranteed purchase price" of $100 a ton for the foam and plastics and $10 a ton for the DRI briquettes. "This service will allow the client to take care of his scrap metal business and guarantees him a stable and safe investment," Salyp says.

And what about operating costs and the like? First off, a complete Salyp ELV Center system is priced at $3.3 million, including all of the equipment noted above as well as six months of on-site assistance from Salyp's engineering contractor, Jacobs Engineering Group Inc. The basic Salyp system, which can be operated by four employees, is designed to process 20,000 to 25,000 tons a year of fluff at a production cost of $20 a ton, the company says. Though specific costs will vary from shredder to shredder, Salyp claims that its system

can turn a profit from its first year onward and pay for itself within five years.

To illustrate the economics of its recycling system, Salyp has created sample balance sheets for its system and offers a financial analysis tool on its Web site that allows clients to plug in their specific information (such as the quantity of fluff they generate, landfill costs in their area, energy and labor costs, and so on) and calculate their projected annual earnings before taxes. (To access these password-protected resources, contact Salyp at info@salyp.com.)

Versatility. The Salyp system isn't limited to recycling shredder fluff, the company notes. It can also be used to recover plastics, foam, and other materials from computers, white goods, mattresses, brown goods (durable consumer products such as TVs and radios), and more.

Timing. Salyp feels it has several time-related factors in its favor, especially in the European Union (EU).

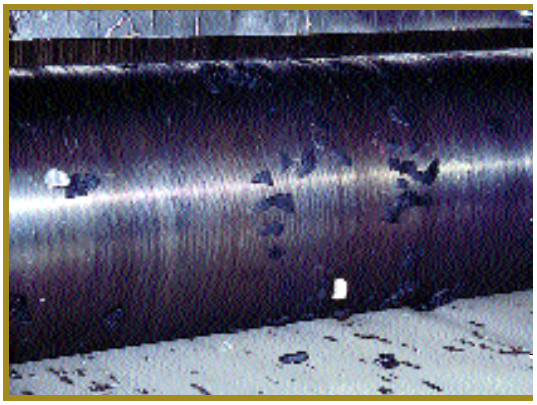
For starters, shredder operators in the EU can face exorbitant landfill fees (such as $100 a ton in Germany or $200 a ton in Switzerland), which gives them a strong incentive to reduce the volume of their fluff. Also, the EU has imposed an ELV directive that requires shredders to increase their per-car recovery rate from the current 75 percent to at least 85 percent by 2006 (of which 80 percent must be from recycling and 5 percent from other means, such as energy recovery) and 95 percent by 2015 (of which 85 percent must be from recycling).

What's more, as of 2006, shredder operators in the EU will face a ban on the landfilling of shredder fluff. These factors are prompting European shredders to explore fluff-recycling options, including Salyp's system. Already, in fact, Salyp has interested parties in the Netherlands, France, and Germany, where plants could be operating as early as the end of 2003.

The bigger question is whether Salyp's technology will find an audience outside of Europe, in countries where landfill fees are manageable and where there's no threat of an ELV directive or fluff-disposal ban.

Salyp maintains that its system should appeal to all shredder operators based on its profit potential, if nothing else. "We don't have to hide behind disposal costs or legislation," says Ivan Vanherpe, one of the firm's CEOs.

Salyp is certainly taking aggressive steps to spread its technology around the world, signing up sales representatives in most EU countries as well as Japan, South Korea, Canada, and the United States (and counting). Salyp's U.S. partner is 21st Century Polymers & Associates Inc. (Auburn Hills, Mich.), led by Richard Abell, a former Chrysler Group executive. According to Abell, 21st Century's expertise in polymer research and technology as well as its close ties with major global automotive OEMs and their suppliers will enable it to "facilitate rapid expansion of Salyp's technology and the overall plastics recycling infrastructure in the U.S., Japan, and Europe." 21st Century has worked with suppliers of shredder fluff and potential customers for recycled plastics for many years, Abell says, which positions it to marry Salyp's system with the North American, Asian, and European markets' supply and demand for recycled plastics.



The Dorado system recovers plastics based on the softening characteristics of different thermoplastic polymers. The system works by heating mixed plastic chips to specific temperatures under banks of infrared heaters (above). At different temperatures, certain plastic chips become "butter soft" and cling to grooved rollers (below), which pull the desired plastics from the mix and convey them into waiting bins (bottom). The recovered plastics can then be sold as chips or extruded into pellets.

If Salyp's recycling system does indeed catch on, the shredding world could be its oyster, especially considering that shredders worldwide annually generate an estimated 10 million tons of fluff, with the United States and Europe generating 3 million tons each. That's a lot of fluff to recycle, and Salyp is confident its technology will be the one to finally do it.

Editor's Note: For more information, contact Salyp N.V., 32/57-22-80-44 (fax, 32/57-22-80-49); info@salyp.com; or www.salyp.com. 21st Century Polymers & Associates Inc. can be reached at rkabell@aol.com.

Kent Kiser is editor and associate publisher of Scrap.